DRYING OF PIPELINES PRIOR TO COMMISSIONING

Reasons for drying of gas pipelines after construction

Water inside a gas pipeline in operation causes a number of problems.

In medium-pressure gas pipelines, house pressure regulators tend to freeze in winter, which is very unpleasant both for the customer, who is suddenly deprived of heating and for the gas company because emergency crews need to go out to the field to repair this, which influences the economics of gas supplies.

In high-pressure pipelines, complications with natural gas hydrates tend to form in addition to the problems with pressure regulating stations. The hydrates may clog even a large diameter pipe. In addition to this operational trouble, water in high-pressure pipelines primarily poses a direct risk of failure. Internal corrosion caused by free water has been already detected in many pipelines.

However, it is only recently that a much more dangerous consequence of free water has been proved in gas pipelines transporting normally treated natural gas—internal stress corrosion cracking (SCC) which, in a relatively short time of operation (several years), may cause a complete failure of extensive stretches of the line. At the same time there is no reliable method at present to detect the creation and beginnings of SCC development on the inside of the pipe wall.

Sources of water inside pipelines

Water enters a pipeline before putting into operation usually due to lack of discipline at work during construction. In some cases, the reason may be the construction technology itself, for example where underground river crossings are laid which requires that the pipe is flooded with water.

Hydrotests or stress tests are another stage of construction when water enters a pipe. This is evident when the tests are carried out using water but we should not ignore tightness tests using air when water contained in air condenses in the pipe after the air is compressed.

Although some of the water is removed from the pipeline when it is cleaned, a significant proportion of water cannot be removed from the pipeline even when repeatedly applying mechanical cleaning techniques using water-absorbing cleaning pigs because the water adheres to the pipe walls due to capillary forces. This water can only be removed by special drying techniques.
CEPS carries out pipe drying before commissioning, using both methods that are currently used throughout the world—deeply pre-dried air and vacuum drying.

Both of these technologies can also be deployed for drying other pipelines facilities (metering stations, interconnecting nodes, etc.) or even pieces of equipment requiring a high level of dryness (chemical apparatuses, high-performance steam turbines, etc.).

**Pipeline drying using deeply pre-dried air**

This technique is suitable for pipes made of steel and plastic materials, and also for process equipment. At first step the air is dried to a temperature of water dew point below −80 °C in a special unit based on a molecular sieve, and then blown into the pipeline for being dried. The water, which is present in the line evaporates into the pre-dried air, and in this air is carried to outside the pipeline.

CEPS has two big units available. Each unit has a drying capacity of one cubic metre of air per second, i.e. 3,600 cu. m/hour. This is sufficient capacity to dry a pipeline having a nominal diameter DN 1000 (40 in.) and a length of 10 to 15 km in one or two days. In case of need (particularly to speed up the drying process) both units can be connected in parallel. Both units are housed in containers and are transported on off-road vehicles capable to manage the navigation throughout the difficult terrain, and therefore can be transported over the construction strip (r.o.w.).

The third one, smaller unit has a capacity of drying 650 cubic metre of air per hour and is used for drying of low profile pipelines.

The units’ operating pressure of 4 to 8 bar is strong enough to push porous cleaning pigs through the pipe during the drying process, which helps to achieve the high rate of drying. At forked/branched pipelines or those whose dimension changes significantly, or in process equipment, i.e. wherever the porous elements cannot be pushed through the equipment, the drying takes a proportionately longer time. The drying of a complex pipeline node, after the hydrotest or stress test water has been simply released, would take several days.

Pipes are dried to the standard level of the temperature of water dew point in the pipe of minus 20 °C. However, in case of need, particularly for process equipment, up to minus 70 °C can be achieved.

**Vacuum drying**

Vacuum drying is based on a generally known physical phenomenon—as the pressure drops, also the boiling point of liquids drops. At an absolute pressure of about 2 kPa, water boils at the temperature of the soil that surrounds the pipe. The drying process by this method should be very carefully followed because at too high pumping speed of the out coming air, pipeline is not sufficient to complement the evaporative heat of water supply through the wall of pipe, but instead the evaporative heat is taken from the water inside the pipe, which causes its cooling.
This phenomenon consequently does not lead to the evaporation of water but water inside pipe freezes. The pipeline then apparently acts as dry, but after putting into operation ice gradually melts and the problems with water appears again. Therefore it is necessary follow carefully process of drying, including control dead time. This dwell time when pumping is stopped, which is repeated according to pipeline diameter prevents water freezing. These dwell times the other hand significantly prolong the drying time.

The vacuum drying is suitable particularly for branched steel pipes and pipeline facilities. For pipes having a nominal diameter of more than DN 500 (20 in.), the geometric stability of the pipes under deep vacuum always needs to be assessed. This technique now cannot be employed with plastic pipes—application of method for this purpose requires to perform the certification tests that are currently carried out.

In comparison with drying based on deeply pre-dried air supported by porous pigs pushed through the pipe, vacuum drying is slower. However, where the porous elements cannot be used, vacuum drying may even be faster for more complex pipeline nodes.

CEPS operates several vacuum units, each one with the capacity of up to 200 cu. m/hour. In case of need, the units can work in parallel.

Vacuum drying is very appropriate for drying complexly shaped distribution network pipes, because in addition to the drying itself, it also makes the first gas admittance into the pipes much easier. The gas is flowing into vacuum and therefore there is no risk of forming an explosive mixture in the pipe, and the pipe does not need to be deaerated.

Both technologies of pipeline drying used by CEPS, meet the requirements of TPG 702 13.